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Early Pleistocene and Early Holocene avifauna of the Cherdzhenitsa Cave, Northwestern Bulgaria

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Introduction

The Cherdzenitsa Cave (also known as Cave N 15) is situated in the Karloukovo Carst Area near the village of Karloukovo (Pleven District; UTM grid KH 68; Fig. 1) at about 200 m a.s.l. It is also considered a part of the Temnata-Prohodna Cave system (Popov, 1994). The Late Pleistocene avifauna of the Temnata Cave (also Temnata Doupka Cave) was published by Boev (1994).

Material and methods

Most of the avian fossils come from the Trench Pr V and are dated back to the Early Holocene (Early - Middle Neolithic; ca. 10 000 - 6 000 B.P.) (Popov, 1994; Vassil Popov - pers. comm.). Material: 1108-1146; 6500-6504. Associated fauna: *Talpa europaea*, *Crocidura leucodon*, *Cr. suaveolens*, *Neomys anomalus*, *Ochotona* cf. *pusilla*, *Spermophilus citellus*, *Dryomys nitedula*, *Glis glis*, *Sicista subtilis*, *Nannospalax leucodon*, *Apodemus sylvaticus/flavicollis*, *Mus* cf. *hortulanus*, *Cricetulus migratorius*, *Mesocricetus newtoni*, *Clethrionomys glareolus*, *Lagurus lagurus*, *Microtus subterraneus*, *M. arvalis/agrestis*, *M. nivalis* and *Arvicola terrestris* (Popov, 1990; Popov et al., 1994).

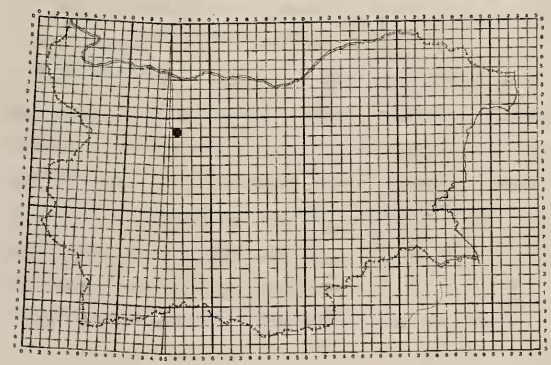

Fig. 1. Location of the Cherdzhenitsa Cave.

The remaining bird finds come from the Trench Pr VI from the entrance hall and are dated back to the Early Pleistocene (1,2 - 1,0 million y. a.; Popov, 1994). Material: 9745-9747. Associated fauna: *Sorex minitissimus*, *S. runtonensis*, *Beremendia fissidens*, *Ochotona* sp., *Spermophilus* sp., *Nannospalax* sp., *Apodemus sylvaticus/flavicollis*, *Allocricetus bursae*, *Cricetus nanus*, *Pliomys simplicior*, *Clethrionomys glareolus*, *Lagurodon praepannonicus*, *L. arankae*, *Miomys pitymyoides*, *M. pusillus*, *Microtus pliocaenicus* and *M. burgondiae* (Popov, 1990).

All avian finds were collected in 1985 and were dated by Dr. Vassil Popov (Institute of Zoology - BAS). They are kept at the Fossil and Recent Birds Department of the National Museum of Natural History - BAS, Sofia (NMNHS). The finds were identified through the avian osteological collection of the NMNHS. Reference measurements are given (in mm) only for the Pleistocene finds. The anatomical belonging of the skeletal elements of each find is shown on Table 1.

Early Pleistocene avifauna

Only 3 bird bones were collected from the Early Pleistocene layers of the cave. We established here *Phylloscopus sibilatrix* (Bechstein, 1793) (Fig. 2 - a) - an obligatory denrophylous species, *Carduelis cannabina* (Linnaeus, 1758) (Fig. 2 - b), inhabiting the open treeless habitats, and *Anthus* sp.

Measurements and comparison

Ph. sibilatrix, No 9746: total length of humerus - 13,0; length of crista pectoralis - 2,9; width of proximal epiphysis - 4,3; thickness of caput humeri - 1,3; width of the diaphysis in the middle - 1,3; width of distal epiphysis - 3,2. The tiny size of the find suggests Troglodytidae and Sylviidae, but morphologically it can only be referred to the last family. *Sylvia* have more elongated caput humeri and longer diaphysis (in species of similar size as *S. communis* Latham, 1787, *S. atricapilla* (Linnaeus, 1758) and *S. melanocephala* (Gmelin, 1789), for example). *S. nisoria* (Bechstein, 1795) is osteometrically much bigger (about 50 %), *Hippolais olivetorum* (Strickland, 1837) is considerably larger according to its humeral bone, *H. pallida* (Hemprich & Ehrenberg, 1833) has shorter crista pectoralis, relatively elongated caput humeri and thinner diaphysis. The European species of genus *Regulus* are much smaller in size, including the size of their humeral bones. *Acrocephallus* spp. have shallower and less developed fossa pneumotricipitalis. Both morphologically and dimensionally the find stands closer to g. *Pylloscopus*. Although of similar size, *Ph. trochilus* has a thinner distal half of diaphysis. *Ph. collyibita* (Vueillot, 1817) is smaller, its humerus and the dorsal edge of its crista pectoralis is more upright than in specimen No 9746. *Ph. bonelli* (Vieillot, 1819) and *Ph. trochiloides* (Sindevall, 1837) also have smaller dimensions. The find fully corresponds to *Ph. sibilatrix*.

Table 1

Species composition, collection numbers and MNI of the fossil birds from the Cherdzhenitsa Cave

Taxa/Age	Collection numbers (NMNHS) and Skeletal elements	Number of finds	MNI
Early Holocene			
GALLIFORMES			
Coturnix coturnix	6501 - coracoid dex.	1	1
PICIFORMES			
Dendrocopus minor	1110 - tarsometatarsus sin. dist.	1	1
PASSERIFORMES			
Hirundo rustica	6502, 6503 - tarsometatarsus sin., 6504 - tarsometatarsus dex.	3	2
Hirundo daurica	1109 - humerus sin. dist., 1124, 1125, 1130 - humerus dex., 1126 - humerus sin., 1127 - carpometacarpus dex., 1128, 1129 - carpometacarpus sin.	8	3
Ptyonoprogne rupestris/ *Riparia riparia*	1131, 1132 - synsacrum copora vertebrorum, 1135, 1137 - carpometacarpus dex., 1136 - carpometacarpus sin.	5	2
Lanius collurio	1133 - humerus dex., 1134 - humerus sin.	2	1
Cinclus cinclus	1143 - humerus sin.	1	1
Turdus merula	1111, 1113, 1115 - humerus dex. prox., 1114, 3142 - humerus sin. prox., 1112 - scapula sin. prox., 1116 - ulna dex. prox., 1117 - apex praemaxillarae, 1138 - tarsometatarsus sin. dist., 1139 - tarsometatarsus dex. prox., 1140 - phalanx prox. dig. majoris sin., 1141 - carpometacarpus dex.	12	3
Turdus philomelos	1118 - coracoid sin dist., 1119, 1120 - carpometacarpus sin., 1121 - carpometacarpus dex., 1122 - carpometacarpus dex. dist.	5	2
Monticola cf. *saxatilis*	6500 - humerus dex. prox.	1	1
Sylvia cf. *atricapilla*	1108 - humerus sin. prox.	1	1
Pyrrhula pyrrhula	1145 - humerus dex., 1146 - carpometacarpus sin.	2	1
Carduelis cannabina	1123 - humerus sin. dist.	1	1
Passer cf. *domesticus*	1144 - tarsometatarsus dex. prox.	1	1
Early Pleistocene			
PASSERIFORMES			
Anthus sp.	9747 - carpometacarpus dex.	1	1
Phylloscopus sibilatrix	9746 - humerus dex.	1	1
Carduelis cannabina	9745 - ulna sin. prox.	1	1
Total		**47**	**24**

C. cannabina, No 9745: total length of the fragment - 13,0; width of proximal epiphysis - 3,0; thickness of proximal epiphysis - 2,0; width of the diaphysis in the middle - 1,3. The general appearance of the find indicates a small passerine bird, and more particularly a species of Fringillidae family. The genera *Coccothraustes*, *Pyrrhula*, *Loxia* and *Pinicola* are considerably larger, while all European species of g. *Serinus* are smaller in size. *S. pussilus* (Pallas, 1811) has smaller dimensions and a relatively thinner diaphysis. *Serinus canaria* (Linnaeus, 1758) has rounder cotyla dorsalis. The ulna of the *Fringilla* species is more robust and bigger. They also have a longer cotyla dorsalis. Morphologically the find is closer to g. *Carduelis* and resembles *C. cannabina*. *C. chloris* (Linnaeus, 1758) has shorter olecranon ulnae and relatively thicker diaphysis. *C. carduelis* (Linnaeus, 1758) has more erected olecranon ulnae.

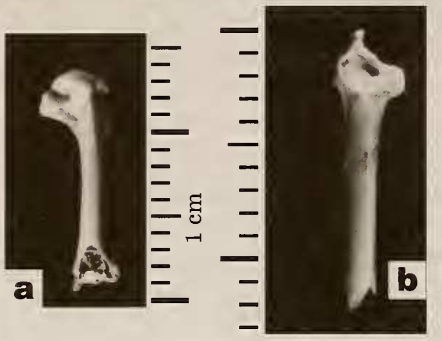

Fig. 2. Some of the Early Pleistocene avian fossils from the Cherdzhenitsa Cave: a - *Phylloscopus sibilatrix* - humerus sin., No 9746; b - *Carduelis cannabina* - ulna sin. prox., No 9745 (Photographs: Boris Andreev).

Anthus sp. (carpometacarpus sin.), No 9747: total length of the fragment - 10,1; length of spatium intermetacarpalis - 6,0; thickness of os metacarpalis majus in the middle - 1,1; thickness of distal epiphysis - 1,2.

Paleoecological comments

The recent populations of *Ph. sibilatrix* in Bulgaria are migratory and inhabit tall and mature broadleaf and conifer forests (Harrison, 1975; 1982). The breeding range is determined by the 15°C and 24°C July isoterms. The species is typical for the *Fagus* forests, but also lives in the mixed forests of *Quercus*, *Carpinus*, *Castanea*, *Picea*, *Betula* etc. (Cramp, 1992). Voinstvenskiy (1960) suggests that it appeared in Southern Europe during the Holocene, simultaneously with the spreading of the decidous forests. The humerus dex., No 9746 is the earliest European record of g. *Phylloscopus* (Tyrberg, 1998).

C. cannabina is a resident and migratory species in Europe preferring openlands with scattered bushes, pastures, meadows, light riverine woods and forests edges (Voinstvenskiy, 1960; Harrison, 1982). The recent Balkan population of *C. cannabina* is resident. The proximal ulna No 9745 (Fig. 2 - b) is the first Early Pleistocene record of the Common Linnet in Europe besides 5 uncertainly dated sites from France, Ireland, Italy, Spain and the United Kingdom (Tyrberg, 1998).

The find of a Pipit (*Anthus* sp.) has no important value for the indication of the type of habitat because of the fact that in Europe the g. *Anthus* includes species from open and treeless, as well as wood habitats (Harrison, 1982).

As it is seen from the established bird species, both woodland and openland habitats were spread in the region of the Cherdzenitsa Cave. Besides the scanty composition, the avifauna confirms at least two of the habitats, determined by the fossil remains of micromammalian fauna for the Early Pleistocene (Popov, 1994; Popov & Delchev, 1997. As Popov (1990) concluded, the forest-steppe and steppe species dominated in that period of the Early Pleistocene in Karloukovo Karst Area.

Early Holocene avifauna

A total of 14 avian taxa were established (Table 1, Fig. 3) from the Trench Pr VI in the Cherdzhenitsa Cave, all of which were also referred to recent species. Thrushes and swallows are the most numerous among the finds. The established avian taxa indicate woodland, rocky, openland and aquatic habitats in the vicinity of the site.

Woodland species

Turdus merula Linnaeus, 1758 is a migratory and resident species from the Boreal and Temperate zone of Europe. It inhabits lowland and plane forests with developed undergrowth (Harrison, 1982). The Blackbird is considered an ubiquist according to its nesting habitat (Cramp, 1988). *Turdus philomelos* C. L. Brehm, 1831 is also a migratory and resident species, but it prefers woods with thick undergrowth (Harrison, 1982), avoiding arid, heat, froze and snowy climate. The Song Thrush is found more often in the lowland forests of *Fagus*, *Betula* and *Quercus* (Cramp, 1989).

Dendrocopos minor (Linnaeus, 1758), *Sylvia atricapilla* (Linnaeus, 1758), *Pyrrhula pyrrhula* (Linnaeus, 1758) indicate a broadleaf deciduous forest landscape. At present the Blackcap is a transmediterranean migratory species resident chiefly in the Western Mediterranean. A woodland species, preferring old mature forests with high undergrowth and forest-steppes (Harrison, 1982). The breeding range of this species is limited at present by the 14°C and 30°C July isotherms. A strongly arboreal bird (Cramp, 1988), *D. minor* is a resident species making irregular migrations within its range. It inhabits broadleaf and mixed forests, rarely coniferous chiefly in the planes up to 800 m a.s.l. (Harrison, 1982). The Lesser Spotted Woodpecker tolerates high and low temperatures. Its distribution is connected with the presence of decaying dead trees, often in the forests of *Quercus*, *Carpinus*, *Salix*, *Alnus* and *Populus* (Cramp, 1989). *P. pyrrhula* is a resident and migratory dendrophylous bird and prefers coniferous and mixed forests with thick undergrowths (Harrison, 1982). The breeding range is limited within the 12°C and 30°C July isoterms. At present it is spread on the Balkans only in the tree belt of the mountains (Cramp & Perrins, 1994).

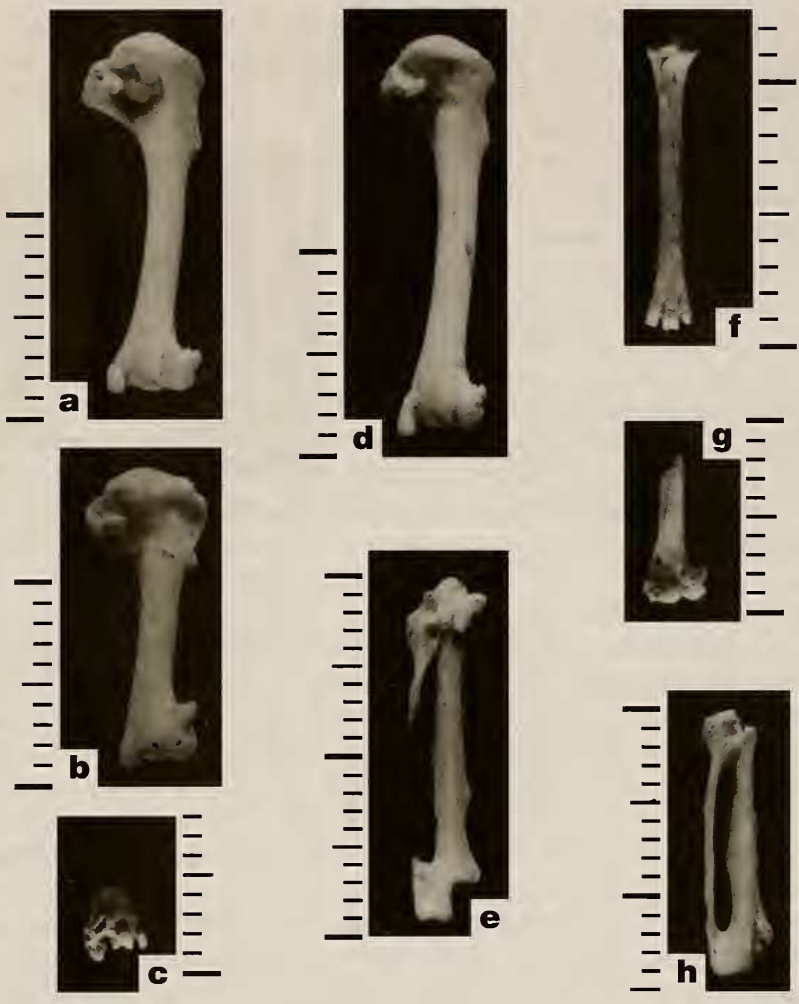

Fig. 3. Some of the Early Holocene avian fossils from the Cherdzhenitsa Cave: a - *Pyrrhula pyrrhula* - humerus dex., No 1145; b - *Hirundo daurica* - humerus dex., No 1124; c - *Dendrocopos minor* - tmt sin. dist., No 1110; d - *Lanius collurio* - humerus dex., No 1133; e - *Turdus philomelos* - carpometacarpus sin., No 1119; f - *Hirundo rustica* - tarsometatarsus sin., No 6502; g - *Carduelis cannabina* - humerus sin. dist., No 1123; h - *Hirundo daurica* - carpometacarpus sin., No 1128 (Photographs: Boris Andreev).

Rocky habitats species

The presence of 3 (4) species of swallows (*Hirundo daurica* Linnaeus 1771, *Hirundo rustica* Linnaeus, 1758, *Ptyonoprogne rupestris* (Scopoli, 1769) and *Riparia riparia* Linnaeus, 1758) shows a relatively wormer climate, allowing Diptera to reach a good abundance. They could be an effective food resource for the swallows only when the density of their populations is higher. The present

geographical distribution of *R. riparia* is limited within the July isotherms of 10 - 12,7°C. *Pt. rupestrisis* is spread between the 20 and 21,6°C July isotherms, while the mean July temperature of 11,6°C limits the distribution of *H. rustica* and that of 20°C limits the distribution of *H. daurica* (Eastham, 1988).

Monticola saxatilis (Linnaeus, 1766) is another petrophylous species. At present *M. saxatilis* is a migratory species in Europe from the southern parts of the Temperate zone. It winters in the Subtropical and Tropical zones, and inhabits dry open mountain rocky slopes and gorges with scarce xerophilous vegetation (Harrison, 1982; Cramp, 1988).

Openland species

Openlands were also present in Early Holocene surroundings of the cave. *Coturnix coturnix* (Linnaeus, 1758), *C. cannabina* and *Passer domesticus* (Linnaeus, 1758) inhabit open field grassy terrains, while *Lanius collurio* Linneus, 1758 prefers open areas with scattered trees and shrubs (Harrison, 1975). In Europe the common Quail is a resident and migratory species, whose distribution is limited by the 15°C July isotherm. It inhabits grassy terrains in planes with dry soil, meadows and semideserts (Harrison, 1982) and prefers open hilly habitats without trees and shrubs (Cramp & Simmons, 1980). In Europe *L. collurio* is a migrator which inhabits openlands with dry soils and scattered thorny bushes and rare trees (Harrison, 1982). It also nests in areas limited by the 16°C July isotherm and prefers sunny warm and dry habitats (Cramp & Perrins, 1993). (For *C. cannabina* see the comments above on the Early Pleistocene records.).

At present *P. domesticus* is a resident species from Boreal to Subtropical zone closely connected with human settlements (Harrison, 1982). It avoids closed large woodlands and openlands without bushes. The breeding range is limited northward by the 10°C July isoterm (Cramp & Perrins, 1994). Voinstvenskiy (1960) considers *P. domesticus* as an ancient autochtonous species in the European steppes.

Popov (1994) has established the presence of warmer and more humid climate in the first half of the Holocene, resulting in wider distribution of forest elements among the small mammal fauna. Popov (in press) has also writtern about "... a forest expansion during the course of Holocene due to an increase in temperature and humidity..." in the vicinity of the Cherdzhenitsa Cave. According to Popov (1990, in press) the climate in the region was dry between 10 000 and 8 300 B. P. and more humid about 6500 B.P. Hence the palaeornithological data from the Early Holocene indicates the presence of a forest or forest-steppe landscape.

Aquatic species

Cinclus cinclus (Linnaeus, 1758) is the only aquatic species, established in the cave deposits. It indicates the presence of a small river with stony bed and, eventually with (small) waterfalls. A chiefly resident species from the Boreal to

the Temperate zone, often making vertical migrations caused by the climatic variations. It is an indicator for the running oligotrophic water basins with stony and gravelly beds (HARRISON, 1982; CRAMP, 1988). The species' range is limited within the 10°C and 22°C July isoterm during the breeding season. Depends on the rock massives, niches and waterfalls.

Conclusions

The fossil avifauna of the Cherdzhenitsa Cave is of great importance because it provides additional data to our scanty knowledge of the appearance and distribution of recent bird species in the Early Pleistocene - Early Holocene. The finds of *Carduelis cannabina* and *Phylloscopus sibilatrix* mark the earliest appearance of these species in the European avifauna.

According to the habitat preferences of the species a presence of the mature mixed broadleaf forests with developed undergrowth, rocky habitats, mountain streams or rivers and open field steppe areas can be suggested. The woodland habitats dominated the forest-steppe landscape in the Early-Pleistocene. The finds from the Early Holocene also indicate a forest-steppe environment.

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Ранно-плейстоценска и ранно-холоценска авифауна от пещерата Чердженица, Северозападна България

Златозар БОЕВ

(Р е з ю м е)

Събрани са 47 костни останки от 24 екземпляра птици, отнасящи се към 16 рецентни вида. Находките са датирани въз основа на съпътстващата фауна от Micromammalia. Основната част от тях произлиза от ранен холоцен (ранен - среден неолит, 10 000 - 6000 г.). Три кости са датирани на ранен плейстоцен (1,2 - 1,0 млн. г.). Видовият състав според биотопичната привързаност на видовете показва наличието през ранния холоцен в района на находището на смесени широколистни гори с подлес, скални местообитания, планински потоци (реки) и открити полски терени. В ранно-холоценския лесостепен ландшафт доминиращо значение имали горските местообитания. В ранния плейстоцен находките от птици също маркират разпространението на горско-степен ландшафт.

Находките на *Carduelis cannabina* и *Phylloscopus sibilatrix* бележат най-ранната поява на тези видове в авифауната на Европа (ранен плейстоцен). Нещо повече - находката на буковия певец е най-ранната находка на рода *Phylloscopus* в цяла Палеарктика. С това пещерата Чердженица придобива ключово значение за допълване на оскъдната информация за състава на европейската авифауна през ранния плейстоцен.